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ART. II.—*Zooecial Variation within Species of the Catenicellidae.*

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Introduction.

A close study of the morphology of the zooecia of both Recent and fossil species of the Catenicellidae has shown the necessity for an understanding of the directions in which the zooecia of species of this group tend to vary. It may be safely asserted that all major zooecial structures vary, within certain limits. This paper attempts to illustrate the extent of variation of the zooecia within species.

Waters (1883) realized that zooecia of the Catenicellidae showed considerable variation, and stated that “. . . until the amount of variation in Recent species has been carefully studied, it will be very difficult for palaeontologists to determine the *Catenicellae*.” Macgillivray (1895) in his observations on *Catenicella hastata* has remarked that it is a very variable species, but his observations are apparently based on specimens of several species of the genus *Costaticella* Maplestone (1899), which are shown to be distinct by their different types of ovicells.

Variation, together with the imperfect state of preservation of fossil specimens, has led to duplication of fossil species by early workers, and it is believed that this contribution will justify the reduction of the number of species recorded from the Victorian Tertiary deposits.

The zooecia of each species figured were taken from the same zoarium, except the fossil zooecia of *Strophipora harveyi* (Wyv.-Th.).

Variations of Zooecia.

OUTLINE.

The shape of the outline of the zooecia depends mainly on the development of the scapular compartments, which feature will be considered later.

The proportion of length to width, often a distinctive character, varies considerably, depending upon the position of the zoecium in the zoarium. Generally speaking, the older zooecia near the base of the main branch are abnormally elongated; higher up on the main branch the zooecia tend to become broader, while the zooecia near the base of the subsidiary lateral branches tend to elongate, those near the tips of the branches becoming broader.

At the extremities of the branches the developing, immature zooecia are generally broadly oval, and show no distinctive character in their outline, owing to the fact that the lateral compartments have not become fully developed.

Zoecia of individual species vary considerably in size, particularly in the genus *Scuticella* Levinsen (1909), although the majority of the zoecia of a zoarium conform to a fairly constant mean.

APERTURE.

The shape and dimensions of the aperture are practically constant. The proximal rim may be made more salient in older zoecia by elevation of the sternal area just proximal to the aperture as in *Cribricellina cribraria* (Busk). The distal rim in young zoecia is not thickened.

STERNAL AREA.

The variation in proportion of length to width of the zoecia and the development of the proximal and distal infrascapular compartments considerably modify the shape of the sternal area.

The fenestrae vary considerably in size and disposition. The variable number of fenestrae depends to a certain extent on the length of the sternal area, which is generally longer in older zoecia. In a specimen of *Scuticella urnula* (MacG.), five, six, seven, eight, and nine fenestrae were seen on different individuals in a continuous series of twelve zoecia.

LATERAL COMPARTMENTS.

In young zoecia terminating the branches, the scapular compartments are the last to develop. They may or may not lodge avicularia. The scapular compartments may be developed upward into long hollow projecting spines in some species. This is found in the younger zoecia of those species which have this characteristic. In old zoecia of such species the spine is rarely developed, and this feature gives an entirely different aspect to the zoecium.

The scapular compartments may develop into enormous avicularia, almost equal in size to that of the zoecium. In *Scuticella plagiostoma* (Busk), large avicularia and others much smaller are developed. The widest range in size of avicularia is seen in *Strophipora harveyi* (Wyv.-Th.). A series of fossil zoecia are figured to illustrate this. They vary from small avicularia surmounting short tubular protuberances to large avicularia greater than the size of the zoecium itself. In *Claviporella aurita* (Busk) also, the avicularia are almost as large as the zoecia.

The direction in which the avicularium faces is fairly constant in some species, but may vary greatly in others. In *Strophipora harveyi* (Wyv.-Th.), they may be directed forward, obliquely laterally, laterally, or backward. In *Scuticella plagiostoma* (Busk), they may face laterally or forward.

The suprascapular compartments in old zoecia of many species of *Scuticella* face forward, whereas in young zoecia of these species, they are directed upward. They also extend much further proximally in the older zoecia, as in *Scuticella ventricosa* (Busk).

Generally in old zoecia the proximal infrascapular compartment is greatly increased in extent, the distal one being correspondingly reduced. They vary slightly in the direction in which they face.

Conclusion.

Zooecial features, in species of the Catenicellidae, vary considerably, and the sum total of the characters of all structures must be considered in the identification of isolated zoecia of species of this group. The variation between old and young zoecia of individual species is particularly remarkable.

References.

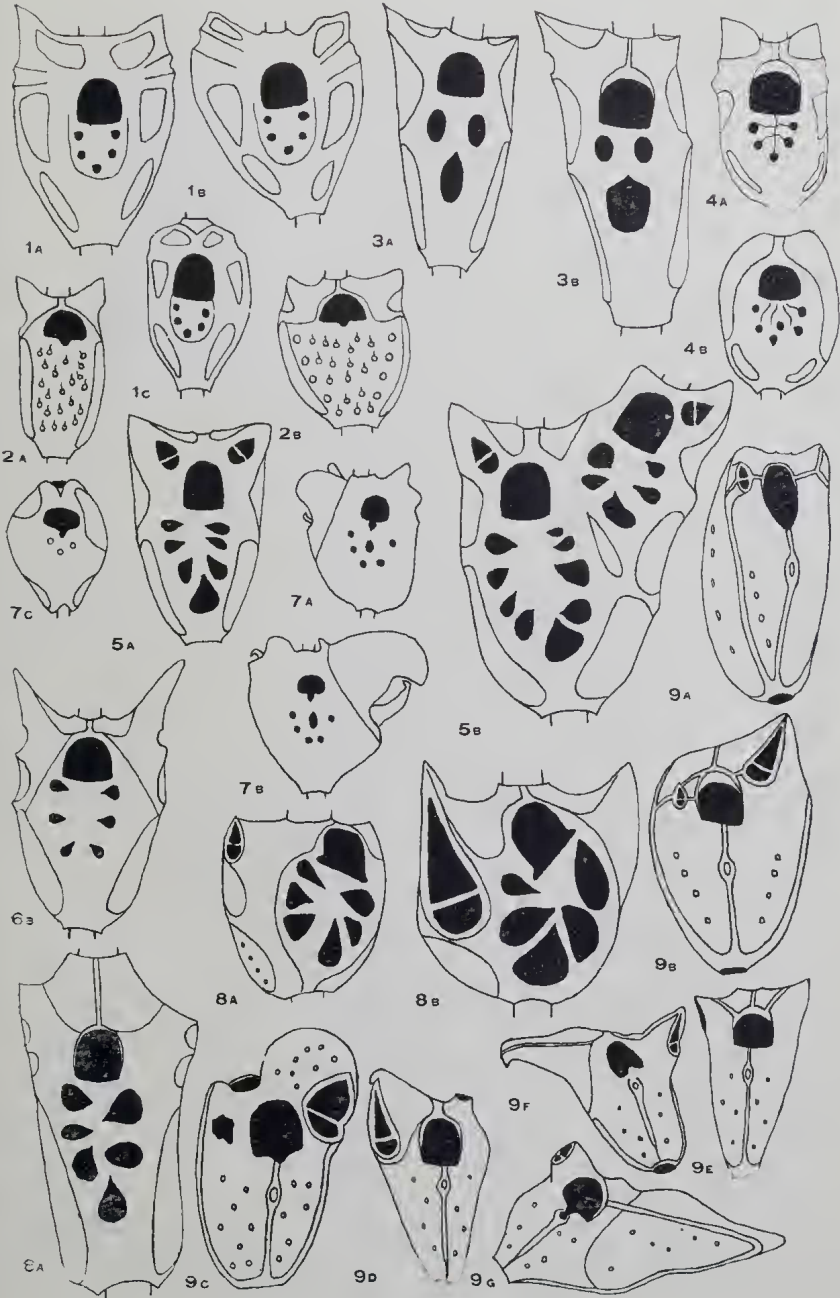
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Explanation of Text Figures.

(All figures drawn with camera lucida.)

- Fig. 1.—*Pterocella alata* (Wyv.-Th.). (a), (b) Zoecia, illustrating variation in proportion of length to width; (c) Young zoecium, scapular and suprascapular compartments not fully developed.
- Fig. 2.—*Cribricellina rufa* (MacG.). (a) Elongate zoecium from base of subsidiary lateral branch; (b) Broad convex zoecium from tip of branch.
- Fig. 3.—*Scuticella lorica* (Busk). (a), (b) Zoecia showing variation in size.
- Fig. 4.—*Costaticella solida* (Levinson). (a) Mature zoecium; (b) Young zoecium, distal lateral compartments not developed.
- Fig. 5.—*Scuticella urnula* (MacG.). (a) Single zoecium showing seven fenestrae; (b) Geminate pair showing nine fenestrae on mother zoecium and five on daughter zoecium.
- Fig. 6.—*Scuticella ventricosa* (Busk). (a) Old zoecium, showing great development of suprascapular and proximal infrascapular compartments, reduction of scapular compartments lacking the upward projection into a hollow spine; (b) Mature zoecium.
- Fig. 7.—*Claviporella aurita* (Busk). (a) Zoecium with normally developed scapular compartment; (b) Zoecium showing abnormally large scapular compartment; (c) Young zoecium lacking distal lateral compartments.
- Fig. 8.—*Scuticella plagiostoma* (Busk). (a) Zoecium showing small laterally-directed avicularium; (b) Zoecium showing large avicularium facing forward.
- Fig. 9.—*Sirophipora harveyi* (Wyv.-Th.). (a) Zoecium showing small forwardly-directed avicularium mounted on tubular protuberance; (b) Zoecium showing large forwardly-directed and small protruding avicularium; (c) Zoecium showing large bulbous forwardly-directed avicularium; (d) Zoecium showing large laterally-directed and small upwardly-protruding avicularium; (e) Zoecium showing two normal laterally-directed avicularia; (f) Zoecium showing abnormally large laterally-directed avicularium; (g) Zoecium showing enormous backwardly-directed avicularium.

(Magnification is in every case $\times 45$.)



Zoecial Variation.